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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/761,916 | 01/21/2004 | James L. Willit | S-101,735 | 4120 |

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UNITED STATES DEPARTMENT OF ENERGY
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WASHINGTON, DC 20585-0162

EXAMINER

SMITH, NICHOLAS A

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| ART UNIT | PAPER NUMBER |
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1742

DATE MAILED: 09/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|-------------------------------|----------------------------------|--|
| Office Action Summary | Application No. 10/761,916 | Applicant(s) WILLIT, JAMES L. | |
| | Examiner Nicholas A. Smith | Art Unit 1742 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 January 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
 4a) Of the above claim(s) 12-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☒ Claim(s) 11 is/are objected to.
- 8) ☒ Claim(s) 12-20 are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>1/21/2004</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-11, drawn to a method of electrorefining of minor actinides and transuranic elements in a fused bath, classified in class 205, subclass 47.
- II. Claims 12-20, drawn to an electrolytic apparatus with a membrane and a fused bath, classified in class 204, subclass 243.1.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another and materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus as claimed can be used to practice another and materially different process, such as electroplating Al using a fused bath. Applicant is reminded that claim 12, lines 1-2, "for the improved electrorefining of actinides and transuranic elements" is a statement of intended use of apparatus. See MPEP 2114.

During a telephone conversation with Bradley W. Smith on 8/25/2006 a provisional election was made with traverse to prosecute the invention of I, claims 1-11. Affirmation of this election must be made by applicant in replying to this Office action. Claims 12-20 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-6 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miller et al. (US Patent 5,531,868) in view of Keller et al. (US Patent 5,810,993).

In regards to claim 1, Miller et al. teaches a process for electrorefining of minor actinides and transuranic elements comprising supplying actinides and transuranic elements in a form of spent nuclear fuel, placing the spent fuel in an anode basket (25, Fig. 1) (col. 2, lines 56-67), contacting an electrolyte containing actinide chlorides with the anode basket and a cathode (col. 3, lines 8-14 and lines 26-30, Fig. 1).

However, Miller et al. does not specifically teach positioning a porous barrier between the anode basket and cathode so as to form an anolyte compartment and a catholyte compartment or causing the concentrations of uranium ions, minor actinide ions, and transuranic ions in the catholyte compartment to decrease.

Keller et al. pertains to electrolytic metal production. Keller et al. teaches positioning a porous barrier (30, Fig. 4) between an anode (6, Fig. 4) and a cathode (4, Fig. 4) to form separate anode and cathode compartments (col. 5, lines 31-58). Keller et al. teaches that positioning the porous barrier causes a high concentration of product metal ion in the anolyte compartment and a lower concentration of product metal ion in the catholyte compartment (col. 5, lines 59-67). It would have been obvious to one of

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ordinary skill in the art to modify Miller et al.'s method with Keller's step of positioning a porous barrier in order to restrict continued dissolution of product metal into electrolyte wherein it can be recirculated back to the anode and re-oxidized, greatly lessening efficiency of the cell (Keller et al., col. 5, line 67 to col. 6, line 3). In the instant case, modifying Miller et al.'s method with Keller et al.'s step would cause the concentrations of product metal ions, such as uranium ions, minor actinide ions, and transuranic ions, to decrease in the catholyte compartment.

In regards to claim 2, Miller et al. in view of Keller et al., which teaches causing a decrease in uranium ion concentration (see above) would occur simultaneously with operation of the cell and thus deposits product metal on the cathode (Keller et al., col. 5, lines 44-47), such as actinides.

In regards to claim 3, Miller et al. in view of Keller et al. teaches a barrier permeable to neodymium ions (Keller et al., col. 5, lines 40-42). While Keller et al. does not specifically teach permeability to actinide ions and transuranic ions, one skilled in the art would expect similar metal ions (such as lathanoid ions and actinoid ions) to have the similar permeability properties.

In regards to claim 4, Miller et al. in view of Keller et al. teaches porous barrier isolating anode reaction products from the cathode (Keller et al., col. 5, lines 59-60).

In regards to claim 5, Miller et al. in view of Keller et al. teaches oxidation of metallic uranium and metallic transuranics at the anode (Miller et al., col. 1, lines 35-61).

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In regards to claim 6, Miller et al. in view of Keller et al. teaches reduction of metallic uranium and metallic transuranics at the cathode (Miller et al., col. 1, lines 35-61).

In regards to claim 8, see reasons stated above for claim 1.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Miller et al. in view of Keller et al. as evidenced by Tomczuk et al. (US Patent 5,009,752).

In regards to claim 7, Miller et al. in view of Keller et al. does not specifically teach the range of applied voltage but instead uses an incorporated reference, Tomczuk et al. (col. 6, lines 47-50), to describe specifics of nuclear spent fuel recovery, wherein the preferable voltage between anode and cathode is above 1 V or 1.25 V.

Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miller et al. in view of Keller et al. and further in view of Boutin et al. (US Patent 5,064,513).

In regard to claim 9 and 10, Miller et al. in view of Keller et al. do not teach specifically increasing thickness of a porous barrier nor decreasing porosity of a porous barrier to further lower uranium ion concentration in catholyte.

Boutin et al. teaches optimizing the porosity of a porous barrier or adjust fiber thickness of a porous barrier in a molten salt bath electrolysis apparatus to lower migration of the product metal ions back to the anolyte compartment, as well as migration of the product metal ions to the catholyte compartment, thus further lowering the product metal ion concentration in the catholyte compartment (col. 3, lines 38-50). In the instant case, lowering porosity or fiber thickness of a porous barrier would lower

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uranium metal ion concentration in the catholyte compartment. It would have been obvious to one of ordinary skill in the art to modify Miller et al. in view of Keller et al.'s method with Boutin et al.'s optimized porosity of a porous barrier in order to ensure transport of current and lower migration of product metal ion back to the anode (Boutin et al., col. 3, lines 38-46).

Allowable Subject Matter

Claim 11 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is an examiner's statement of reasons for allowance: claim 11 specifies that lowering the uranium ion concentration in the catholyte cause preferential deposition of minor actinides and transuranics at the cathode. Miller et al. teaches the recovery process of uranium as well as minor actinides and transuranics in an electrorefining process. Keller et al. teaches the use of a porous barrier to limit transfer of product metal ions from the anolyte compartment to the catholyte compartment in order to keep the product metal from re-oxidizing at the anode and improving cell efficiency. It is the examiner's position that neither Miller et al. or Keller et al. suggest a process of electrorefining of uranium, minor actinides and transuranic elements wherein the minor actinides and transuranic elements are preferentially deposited at a cathode. Furthermore, the combination of Miller et al.'s and Keller et al.'s methods do not specifically mention the operation of the electrorefining process to a point where the catholyte is substantially depleted of uranium ions and consequently only minor

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actinides and transuranic elements are in the catholyte wherein they would be preferentially deposited on a cathode.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Specification

The disclosure is objected to because of the following informalities: insert "Curium (Cm)" in place of "Curium (Cu)", at page 2, end of line 13.

Appropriate correction is required.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicholas A. Smith whose telephone number is (571)-272-8760. The examiner can normally be reached on 8:30 AM to 5:00 PM, Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571)-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

NAS


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